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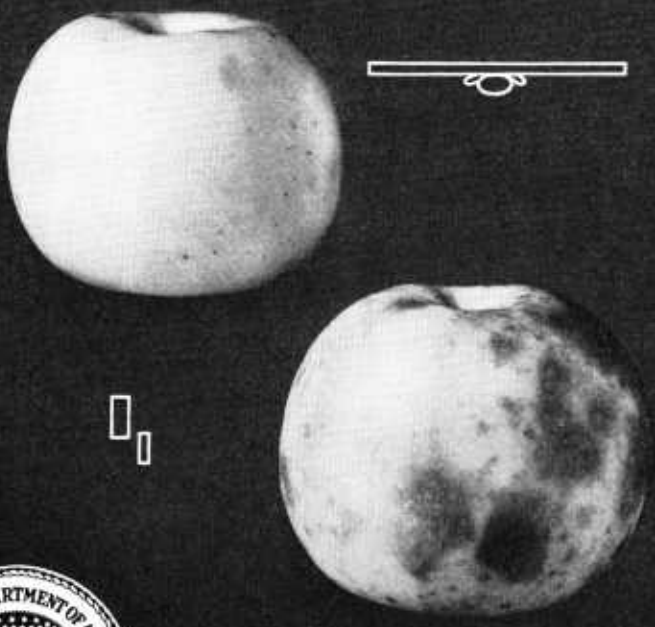
APPLE SCALD *and* ITS CONTROL



SCALD is one of the most serious storage and market diseases of the apple and has an important bearing on all market operations during the latter half of the apple-storage season. The disease may appear while the apples are still in storage, but it makes its most rapid development after they have been removed from storage and exposed to the warmer air of the market or the home.

This bulletin gives a summary of the practical results obtained on scald control in a series of experiments conducted in various sections of the country under commercial storage conditions. It includes the results of tests showing the effect of temperature, aeration, delayed storage, maturity of the fruit, soil moisture, oiled wrappers, and shredded oil paper and states the relative merits of these different treatments in the control of scald.

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APPLE SCALD AND ITS CONTROL

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INTRODUCTION

SCALD is a storage and market disease of apples. It is familiar to the dealer and the consumer, but may be practically unknown to the grower except as it affects the returns from his crop. Scald may appear on apples while still in commercial storage, but it is only after they have been moved to the warmer temperature of the market or the home that it makes its most rapid development. Apples may appear to be in perfect condition upon removal from storage and yet a few days later have their market value reduced 15 to 30 percent or more on account of the development of scald. A disease that makes such a sudden appearance at a time when the apples are ready for consumption naturally has a very disturbing effect upon market operations, resulting in heavy losses and tending to limit distribution and decrease consumption.

APPEARANCE AND CHARACTERISTICS OF SCALD

In mild cases of scald the apple is merely tinted with brown, the skin remaining firm, but in more severe cases the skin tissue may be broken down to the extent that it sloughs off readily from the underlying flesh. In some instances the flesh becomes dead and brown to a depth of half an inch, and the disease takes on an appearance somewhat similar to that of apple rot; but true rot usually spreads down into the flesh in more or less conical shape, whereas scald affects a considerable area of the apple to a rather uniform but shallow depth. An apple that has had its skin killed by scald becomes the ready prey of the various rot organisms, and they soon finish the work of destruction that the scald has begun.

Scald differs from all other apple diseases in being more prevalent on the green side of the apple. Bright-red areas on mature fruit are highly resistant to scald, and yellow surfaces are much more resistant

than those that are green or that show the first stages of turning from green to yellow.

Apple scald is a nonparasitic or physiological disease. It is not brought about by the presence of foreign organisms, but is due to certain unfavorable conditions to which the apples are sometimes subjected. Seasonal and orchard conditions are involved, as well as those that prevail in transportation, in storage, and on the market.

EFFECT OF ORCHARD CONDITIONS

MATURITY OF THE FRUIT

The maturity and color of the apples at picking time are very important factors in determining their susceptibility to scald, the more

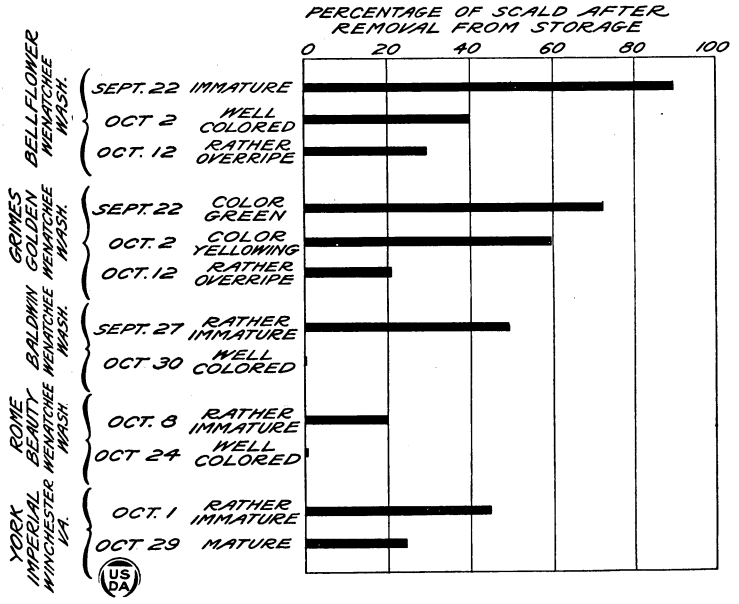

FIGURE 1.—Effect of maturity of fruit upon development of scald after removal from storage. Notes on the Virginia apples were taken February 25 and those on the Washington apples March 12 to 19.

mature fruit scalding less than that which is greener. The effect of the time of picking upon the later development of scald is brought out in figure 1.

The results varied widely in the different tests, but in general the fruit that was well matured but not overripe developed less than half as much scald as that which was picked green.

Color and maturity are influenced by the weather conditions, the pruning, the soil, the fertilizer, and the general orchard management, as well as by the time of picking. Heavy applications of nitrogenous fertilizers make the apples more susceptible to the disease. Good exposure to sunlight produces high color and makes the apples more resistant to scald. However, the red bud sports of Delicious, Stayman Winesap, and Rome Beauty become well colored before they are mature enough to develop resistance.

SOIL MOISTURE

The effect of soil moisture upon the susceptibility of the fruit to scald can be tested most satisfactorily under irrigation conditions. Figure 2 gives the results of irrigation and storage experiments made at Wenatchee, Wash. The apples from the heavily irrigated trees developed about three times as much scald after removal from storage as those from the lightly irrigated trees. It is impossible under nonirrigated conditions to control the amount of water supplied to the soil, but it is worth while to know that apples that have been forced either by heavy rains or by heavy irrigation have thereby become more susceptible to scald.

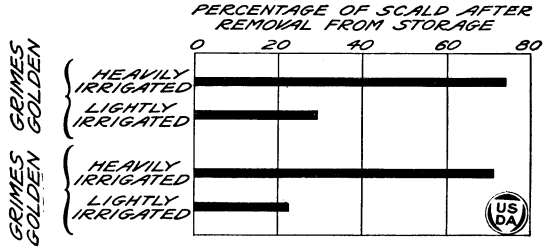

FIGURE 2.—Influence of soil moisture upon the susceptibility of the fruit to apple scald.

SIZE OF THE APPLES

In general, large apples are more susceptible to scald than small ones, but this difference in susceptibility is apparently not due so much to size in itself as to the forcing that induces the size and the immaturity and poor color that usually accompany it. Apples may develop a good size without becoming unduly susceptible to scald.

EFFECT OF PACKING-HOUSE, TRANSPORTATION, AND STORAGE CONDITIONS

The orchard and seasonal conditions modify the susceptibility of the fruit to scald, but the conditions that prevail after the apples are picked determine the extent to which this susceptibility will be expressed in actual scald. These various conditions are considered separately under the heads of Temperature, Aeration and Ventilation, etc. Although the apples are removed from the tree, they are still alive, and carrying on most of their life processes. They have been cut off from their original source of food and water, and must be given conditions that will conserve their stored supplies and yet allow their life functions to proceed in a normal manner.

TEMPERATURE

Low temperature is the best means known of prolonging the life of the apple and is also a most important agency in delaying the development of scald. Figure 3 shows the results of storage experiments on eastern Grimes Golden and York Imperial apples at constant temperatures ranging from 32° to 50° F. An increase of 9° in the storage temperature has resulted in two to three times as much scald

upon removal from storage on a particular date. It will be seen from the two sets of data on the same lot of Grimes Golden that the effect of low temperature is that of delaying scald rather than preventing it, the disease being as serious at 32° at the end of 16 weeks as it was at 41° at the end of 12 weeks.

It is important that the apples be cooled as quickly as possible after picking. They should be delivered to the storage plant promptly, and the storage conditions should be such that there will be the least possible delay in bringing the fruit to the final storage

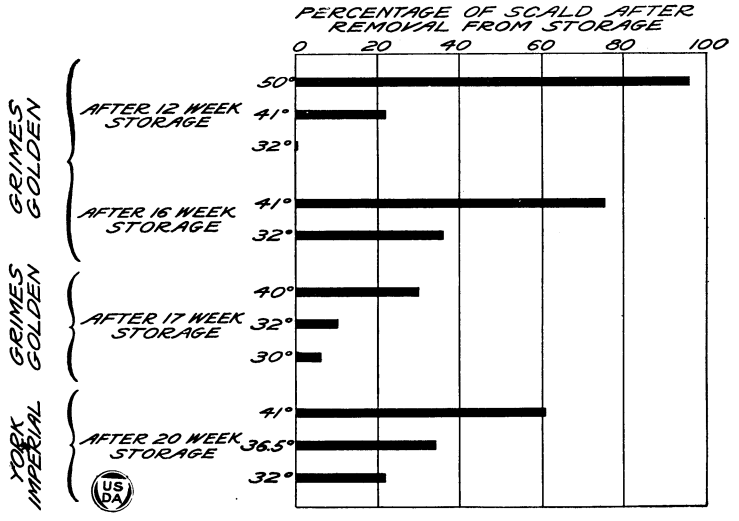

FIGURE 3.—Effect of temperature upon apple scald.

temperature. Placing large quantities of warm fruit in a single room or pile results in delayed cooling and consequent increase in scald.

DELAYED STORAGE

Many serious losses from scald are the after effects of delayed storage. Figure 4 shows the contrast in scald between apples that were stored immediately in rooms held at 32° F. and others of the same lots that were delayed in the storage hallway or at outside temperatures. It will be seen from the relative length of the bars that scald was greatly increased by the delay.

Apples that are delayed in unrefrigerated cars, in closed packing sheds, or in large stacks under any condition are almost certain to have their tendency to scald greatly increased and their storage life decidedly shortened by the treatment.

AERATION AND VENTILATION

Free exposure to the air is often as important in scald control as low temperature, and it actually decreases the tendency of the fruit to scald instead of merely delaying the development of the disease.

Aeration During Delay

There is no other condition under which good air movement over the apples is so important as in cases of delayed storage. The serious damages resulting from delays at outside temperature are shown in figure 4, while the possibility of turning misfortune into advantage and actually reducing scald by means of aeration during the delay is shown in figure 5. There was little or no difference in the temperatures to which the different lots of fruit were exposed, but the delayed apples in the first case were almost entirely protected from air cur-

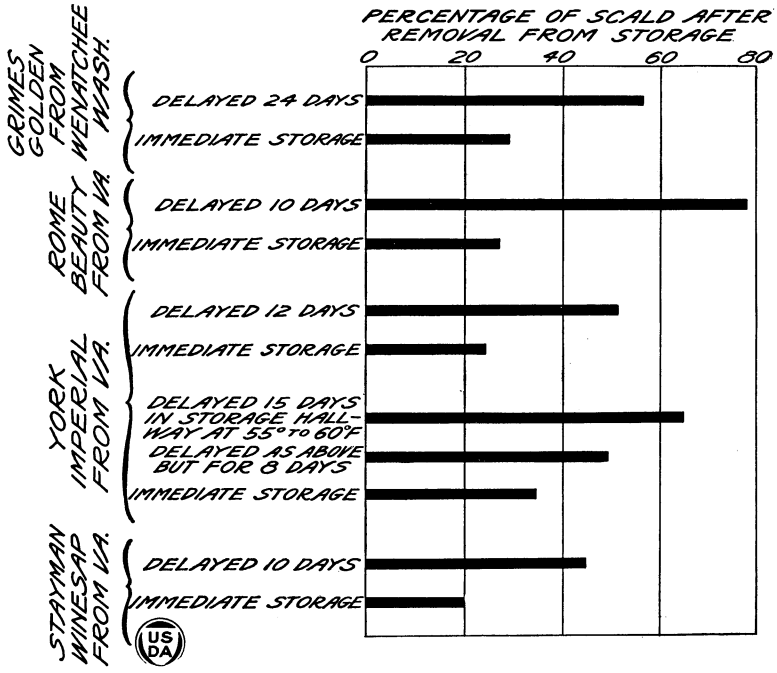

FIGURE 4.—Effect of delayed cold storage upon the development of scald after removal from cold storage. The Grimes Golden apples were packed in boxes and the other varieties in barrels. The Grimes Golden and Rome Beauty were delayed in closed rooms, the Stayman Winesap and the first lot of York Imperial in a partly closed shed, and the second lot of York Imperial in the cold-storage hallway.

rents, while those described in figure 5 had free exposure to the outside air. When immediate refrigeration is impossible, a great deal can be accomplished in scald control by keeping the apples in the shade and giving them the freest possible exposure to the air, but it should be borne in mind that delay in cooling is always favorable to the development of rots and always shortens the life of the apple.

Aeration in the Storage Plant

Apples that are in the aisles or near the doors of the cold-storage rooms scald less than those that are located in the middle of the stacks (fig. 6). Whatever contributes to the openness of the storage stacks and to the freedom of air movement over the apples is of value in scald control.

Apples often scald less in the cellar and in air-cooled storage than in commercial cold storage. When this occurs the benefits of the better air movement have outweighed the harmful effects of the higher temperatures insofar as scald is concerned. If storage cellars and air-cooled plants are tightly packed with fruit and but little attention is paid to ventilation, scald is likely to be extremely bad.

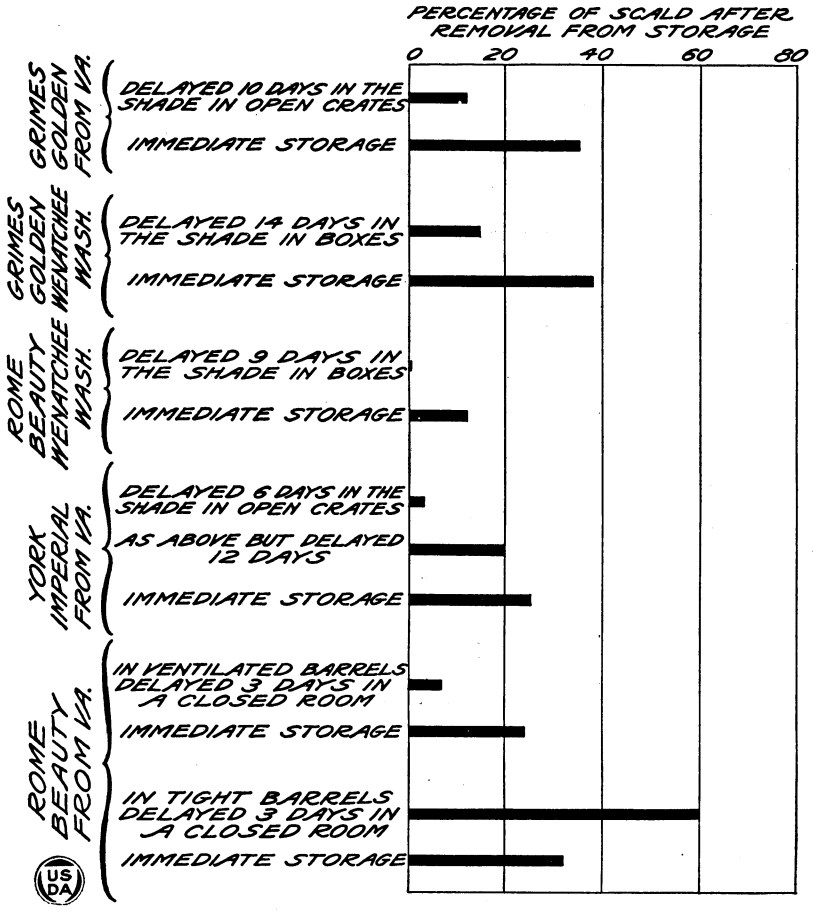

FIGURE 5.—Effect of aeration during the delayed storage upon the development of scald after removal from cold storage.

It is the aeration and the ventilation given during the first 6 or 8 weeks of storage that are of greatest value in scald control. After this time the more susceptible varieties are liable to have developed a tendency to scald that ventilation cannot correct.

Ventilated Packages

The effect of the openness of the package upon the development of scald is brought out in figures 5, 6, 7, and 8. The tight barrels were those in ordinary use for apple packing, and the ventilated barrels differed from the tight ones in having 15 holes cut in the staves,

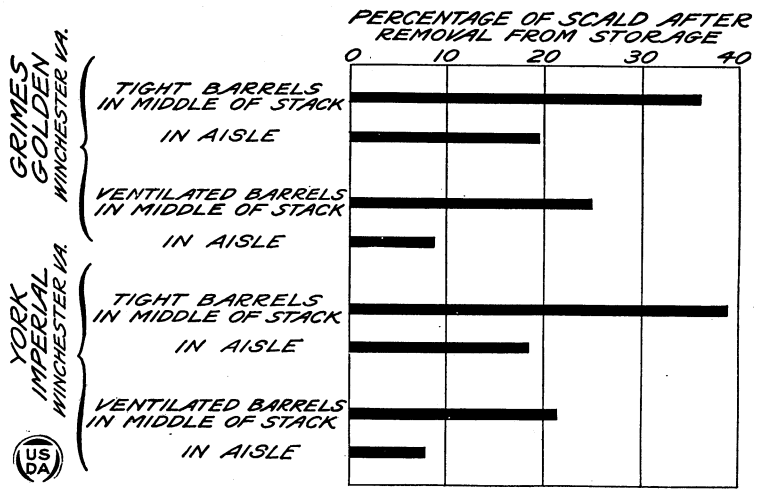

FIGURE 6.—Effect of location in the storage room upon development of scald after removal from cold storage.

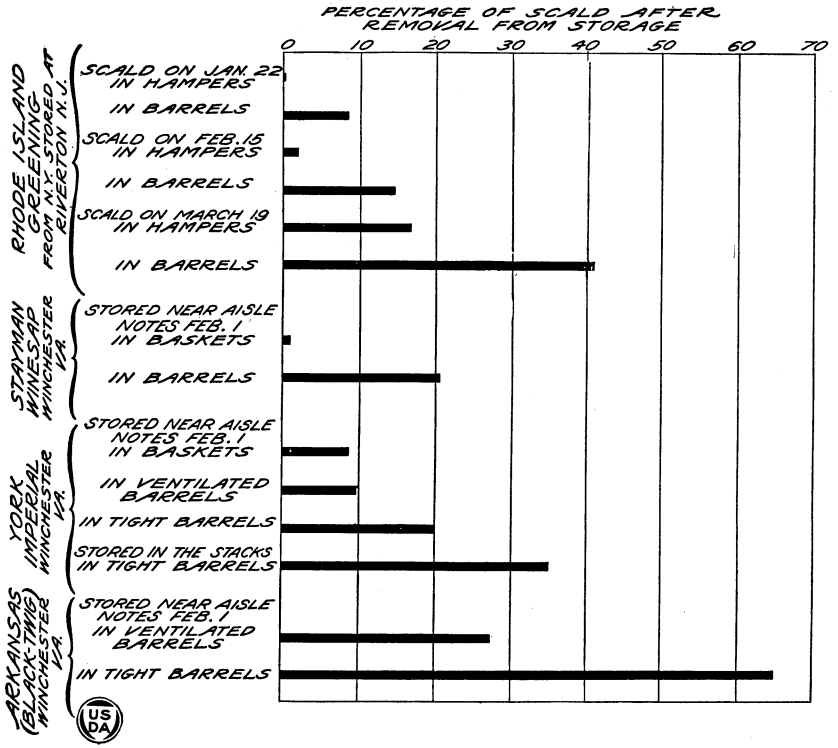

FIGURE 7.—Effect of openness of storage package upon development of scald after removal from cold storage.

each five-eighths of an inch wide by 4 inches long. The baskets and hampers were of the types in most common use for apples, the baskets having overlapping slats, whereas the hampers had openings between the slats.

In general, there was less than half as much scald on the apples in the open packages as was found on those in the tight barrels, and with the Rhode Island Greening in hampers and the Stayman Winesap in baskets the contrast was even greater than this.

The apples in the ventilated packages cool more quickly in storage than those in the tight ones, and this in itself is of value in scald control as well as in the prevention of rots and the conservation of the life of the apple; but the greatest value of the open package

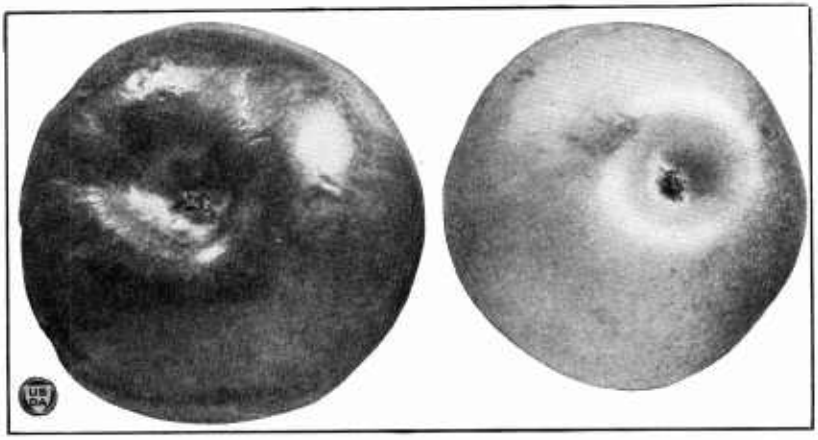

FIGURE 8.—Rome Beauty apples from Vienna, Va., picked September 27, and delayed 10 days in reaching storage. Part of the fruit was packed in tight barrels and part in ventilated ones. The scalded apple shows the condition of the fruit from the tight barrels on January 28 of the following year after removal from storage. The apple free from scald (at the right) shows the condition of the fruit in the ventilated barrels.

so far as scald is concerned lies in the free exposure of the apples to the air.

Apples also usually scald less in boxes than in barrels, but boxes are often stacked so tightly that the value of their openness is largely lost, while this cannot be readily done with the hamper.

The question naturally arises as to what the air brings to the apples or what it carries away that makes its free circulation of value in scald control. A complete and final answer to this question is not yet available, but it is known that apples scald less when dry than when held under conditions of excessive humidity.

The results of investigations, however, do not indicate that the drying effect of the air is the major factor in the control of scald, for it has been found possible to prevent the disease with good aeration even when the air was practically saturated with moisture.

Carbon Dioxide and Oxygen

It has been proved that the scald control resulting from air movement is not due to the oxygen brought to the apple nor to the carbon

dioxide carried away; in fact, it has been found that high percentages of carbon dioxide delay the ripening of the apples and greatly decrease the development of scald.

Odorous Substances

It is known that certain of the various substances that produce the odor of the apple may become definitely harmful to it when present in great concentration and that the injuries produced are similar to scald in appearance. It seems probable that the value of aeration in scald control is largely due to the removal of these odorous products thrown off by the apples.

SCALD CONTROL BY OILED PAPER

OILED WRAPPERS

A most efficient and practicable method of scald control is to be found in the use of oiled-paper wrappers. Table 1 shows the results of tests covering 5 years on commercial lots of apples in the East and in the Pacific Northwest. The western apples were packed in boxes and the eastern ones in barrels. The results show the efficiency of the oiled wrapper under both conditions, but it should be noted that it is not considered practicable to pack wrapped fruit in barrels.

TABLE 1.—*Effect of oiled wrappers on development of scald as shown by records taken after removal of the apples from cold storage*

Variety	Degree of scald		Variety	Degree of scald	
	Oiled wrappers	Unoiled wrappers or unwrapped		Oiled wrappers	Unoiled wrappers or unwrapped
Eastern apples:	*Percent*	*Percent*	Northwestern apples—Con.	*Percent*	*Percent*
Grimes Golden, 5-year average	0.0	50.6	York Imperial, 2-year average	0.7	49.0
York Imperial, 4-year average	.8	49.5	Stayman Winesap, 4-year average	.2	18.8
Stayman Winesap, 3-year average	5.6	33.3	Delicious, 1 year	0	6.0
Arkansas, 3-year average	1.9	52.0	Rome Beauty, 4-year average	0	30.8
Rhode Island Greening, 2-year average	.5	24.5	Arkansas, 3-year average	3.3	28.3
Yellow Newtown, 1 year	0	15.0	White Pearmain, 2-year average	0	20.5
Northwestern apples:			Arkansas Black, 3-year average	.1	7.0
Grimes Golden, 4-year average	.1	26.8	Yellow Newtown, 1 year	3.0	33.0
			Winesap, 3-year average	0	15.0

The oiled wrappers did not completely control scald in all cases, but they held the disease in check to a remarkable degree and to an extent that materially affected the market value of the fruit. Under average market conditions 5 percent of scald on the box apples or 10 percent on the barrel apples would be liable to mean a discount in price, and 25 percent of scald on the box apples or 50 percent on the barrel apples would be likely to result in the market price being cut 25 percent or more. It will be seen that nearly all of the apples that were unwrapped or in unoiled wrappers had a much depreciated market value on account of scald, whereas those in oiled wrappers were either entirely free from the disease or so nearly free that their market value was but little affected. The comparative condition of

the Yellow Newtown under the two methods of packing is shown in figure 9.

The oiled wrappers have also been tested on apples that were held in cellar and air-cooled storage and on others that were delayed in

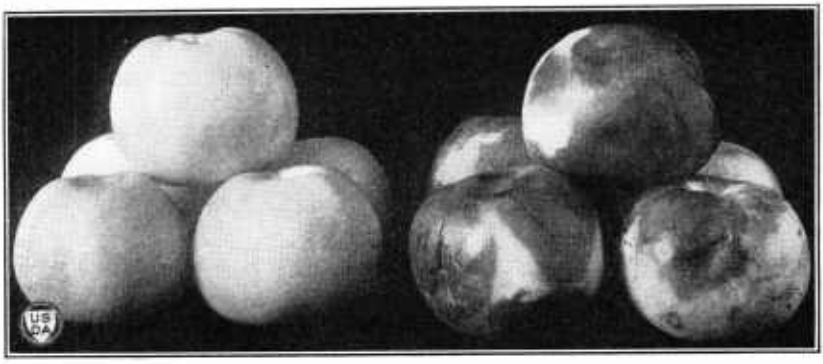

FIGURE 9.—Yellow Newtown apples from Winchester, Va., picked on September 30 and photographed the following July 1. The apples on the left were in oiled wrappers, whereas those on the right were unwrapped.

reaching cold storage. Under all these conditions they have either entirely controlled scald or greatly reduced it. The effect of oiled wrappers has shown to a great advantage in after-storage shipments

FIGURE 10.—Grimes Golden apples removed from cold storage at Wenatchee, Wash., February 13, shipped in small lots by warm express to Washington, D. C., arriving February 20; in cold storage February 21 to 26; in warm room for exhibition purposes from February 26 to March 1; photographed March 1.

of fruit. Figure 10 shows the comparative conditions of Grimes Golden in oiled and unoiled wrappers after shipment across the continent by ordinary express.

The scald control obtained with the oiled wrappers has been largely in the nature of removing the tendency to scald rather than

merely delaying the development of the disease. Figure 11 shows the development of scald at various times during the storage season on eastern apples that were held in oiled wrappers and on similar apples that were unwrapped. Scald made some increase on the fruit in oiled wrappers as the season advanced, but very much less than it

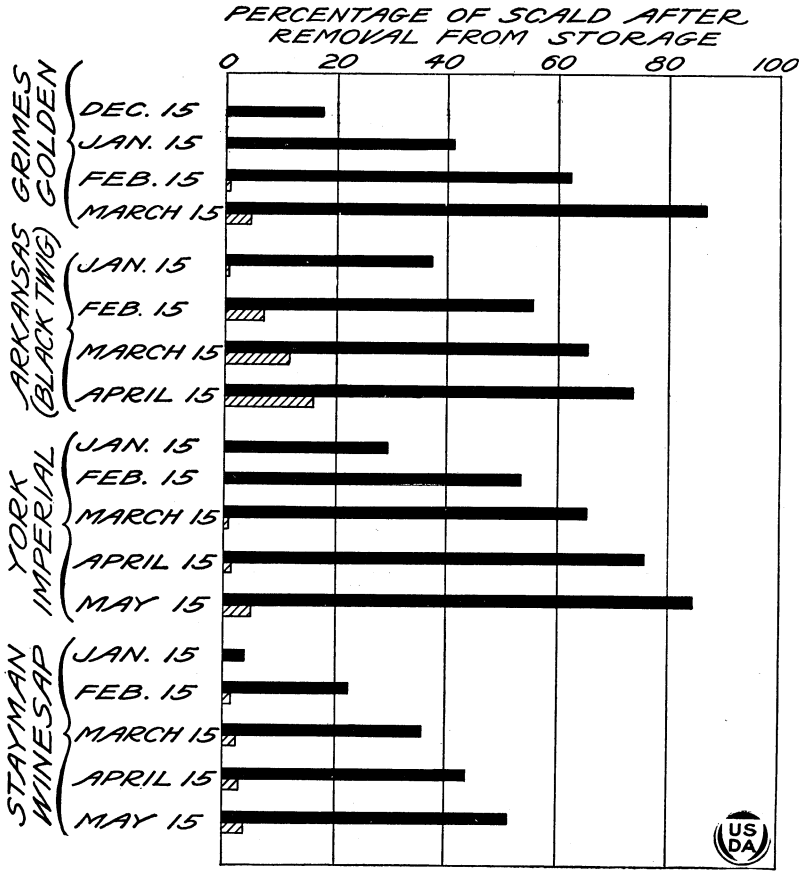

FIGURE 11.—A comparison of scald on apples in oiled wrappers with that on unwrapped apples at various times in the storage season. The results shown are the average for experiments covering 5 years and include tests on four different lots of Stayman Winesap, nine different lots of York Imperial, and six different lots each of Grimes Golden and Arkansas. The degree of scald on the unwrapped fruit is indicated by the solid bar and that on the fruit in oiled wrappers by the shaded bar.

made on the unwrapped fruit. In all cases there was less scald on the apples in oiled wrappers toward the end of the storage season than was found on the unwrapped fruit 3 months earlier.

The Arkansas (*Mammoth Black Twig*)[1] has given greater difficulty in scald control than any other variety tested. In two out of the six tests that have been combined to make the average for

[1] Some of the fruit included under the name of this variety may have been the Paragon, a variety indistinguishable from the Arkansas in the trade, very similar to it both in its habits of growth and in its keeping qualities and, so far as the writers have observed, similar in its susceptibility to scald.

the variety as shown in figure 11, the apples in oiled wrappers showed enough scald by the middle of February to affect their selling price, and by the middle of April a third of the oiled-wrapper lots had moved up to this point; but the three other lots remained practically free from scald, and the average scald for the six lots in oiled wrappers on April 15 was less than half as much as was found on the unwrapped fruit 3 months earlier. These results with the eastern-grown Arkansas are the poorest that have been obtained in a total of more than 80 different commercial tests with oiled wrappers.

The oiled wrapper must carry at least 15 percent of its finished weight in odorless, tasteless mineral oil if it is to give satisfactory scald control, and 18 to 20 percent of oil is highly desirable. Still higher percentages of oil (25 to 35 percent) would probably add something to the efficiency of the paper but would be difficult to prepare commercially.

SHREDDED OILED PAPER

In the basket and barrel packages shredded oiled paper takes the place of the oiled wrapper. The paper should be cut so as to be readily scattered in the barrel. Strips about 5 inches long and three-eighths of an inch wide have met with rather general approval among growers.

A paper that is somewhat resilient and springy is better than one that is soft and inclined to mat. It is easier to shake apart after it has been baled, and when thrown into the package it has a greater tendency to spread out between the apples and give the maximum contact with them. Like the oiled wrapper, the shredded oiled paper must carry at least 15 percent and preferably 18 to 20 percent of its weight in odorless, tasteless mineral oil.

If evenly distributed, half a pound of paper to the bushel is usually sufficient to give satisfactory scald control; three-quarters of a pound has given better results and is often advisable with susceptible varieties.

Scald Control in the Barrel Package

The results of 19 different tests with shredded paper, covering 7 different varieties, are shown in table 2 and in figure 12. The records were taken after the fruit had been out of storage and in a warm room for 3 days. The percentages are based on the number of apples having sufficient scald to be discriminated against on the market, the apples having mere traces or touches of scald not being included.

TABLE 2.—*Tests in the control of scald in eastern apples in barrels with shredded oiled paper*

Variety	Apples scalded		Variety	Apples scalded	
	Packed with paper	No paper		Packed with paper	No paper
	Percent	*Percent*		*Percent*	*Percent*
Grimes Golden, 3-year average	9.3	81.0	Yellow Newtown, 1 year	0	28.0
York Imperial, 7-year average	2.9	59.0	Ben Davis, 1 year	0	45.0
Stayman Winesap, 2-year average	.0	60.0			
Rhode Island Greening, 1 year	1.0	69.0	Average	4.0	67.0
Arkansas, 4-year average	7.0	89.5			

On the untreated apples the average percentage of scald was 67, whereas on the apples with shredded paper the average was 4. The reduction in the disease from the use of the shredded paper is very significant. The experiments of table 2 were all made on barrel apples, but similar tests have also been made with apples in hampers, baskets, and boxes with equally good or somewhat better success in scald control.

Distribution of Paper in the Package

In the experiments reported in table 2 the shredded paper was well distributed in the barrel, practically every apple coming in contact with the paper. Other tests were made where several layers of apples were run in between the layers of paper, resulting in many apples being entirely out of contact with the paper. A part of these tests were made in connection with the tests reported in table 2 and

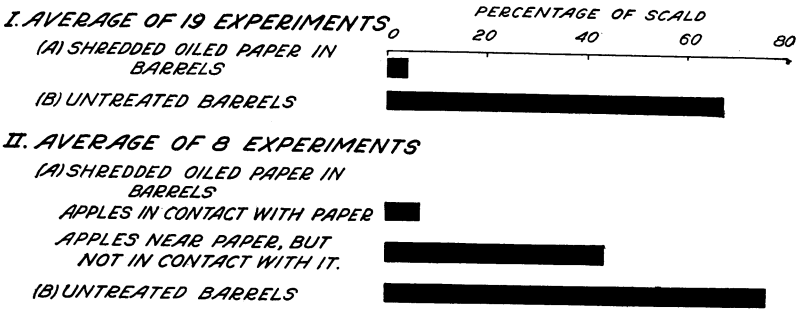

FIGURE 12.—Results of experiments in the control of apple scald with shredded oiled paper.

part as independent experiments. The results are shown in table 3 and also in figure 12.

TABLE 3.—*Results with poor distribution of shredded oiled paper in barrels of apples*

Variety	Apples scalded			Variety	Apples scalded		
	Paper in barrels				Paper in barrels		
	Apples in contact with paper	Apples having no contact with paper	Barrels with no paper		Apples in contact with paper	Apples having no contact with paper	Barrels with no paper
	Percent	*Percent*	*Percent*		*Percent*	*Percent*	*Percent*
York Imperial	11	43	95	Yellow Newtown	0	21	28
Do	5	58	62	Rhode Island Greening	2	20	69
Stayman Winesap	2	53	96				
Arkansas	0	27	91	Average	7	43	76
Do	22	58	93				
Do	12	67					

In two instances the development of scald on the apples that were in the barrels with shredded paper but out of contact with the paper was little different from that on the apples in the untreated barrels, but in the other five cases scald was decidedly reduced on the apples in barrels with paper even when out of contact with the paper.

As compared with the apples in contact with the paper, the scald control on those out of contact with it but near it was a decided failure. The average for the seven tests gives 7 percent of scald on the apples in contact with the paper, 43 percent on the apples of the same barrels that were near the paper but not in contact with it, and 76 percent for the apples in the untreated barrels.

The results show that thorough distribution of the paper is essential to good scald control. It is also a decidedly vital matter in the success of the shredded-paper treatment in general. If packages that are offered on the market as containing shredded paper are found to have 40 percent or more of the apples scalded in certain parts of the barrel, the price is liable to be set on the basis of the poorest rather than the best of the apples and the conclusion drawn that the shredded paper has added nothing to the market value of the fruit.

One of the greatest obstacles in the control of scald with shredded oiled paper is the rather common habit with growers and packers of running a large quantity of apples into the package at one time. This is done for the sake of speed and because of the rush of work during the packing season, but it precludes the successful use of the shredded paper. If the paper is to be scattered over the apples only between the runs, good scald control requires that not more than two layers of apples across the package should be run in at one time, and if the variety is particularly susceptible to scald, one layer of apples at a time is much to be preferred. Small runs and frequent shaking have a value, aside from the control of scald, in the way of producing a tighter pack that is less likely to require plugging later in the season.

The shredded paper must always be shaken apart before being thrown into the barrel. Large mats and heavy layers of paper not only prevent the paper from having its full efficiency in scald control but also give a temporary bridging effect that results in the package becoming slack later in the season.

The face layers of apples should receive their share of the oiled paper. There should be a layer of paper between the face layer of apples and the corrugated cap. The writers have seen instances where the face layers were left without paper and where scald was confined almost entirely to these layers.

CRITICAL PERIODS IN SCALD CONTROL

The life of the stored apple may be divided into four different periods or stages with reference to the development of scald.

The first period begins with the picking of the fruit and, with the more susceptible varieties, ends with the sixth or eighth week of storage. During this time the scald-producing agencies are apparently most active; yet up to the end of the period it is possible largely or entirely to overcome any accumulated tendencies to the disease by placing the apples in oiled paper or by giving them a very thorough airing.

The second stage in the development of scald extends over a period of 5 to 8 weeks following the first period. Preventive measures now become of little or no avail. The apples may be destined to scald if given sufficient time, yet if removed from storage before the end of

the 5 to 8 weeks they do not show scald, even upon warming. If the apples are consumed before the end of this second period the scald problem is avoided.

The third period starts with the end of the second period and covers the remainder of the time fruit is in storage. The apples now become latently or potentially scalded; certain skin cells are practically dead, yet they remain green and appear normal if not exposed to warm air.

The fourth period includes the life of the apple after its removal from storage and exposure to warmer air. The affected skin turns brown and completes its death processes. The apple is deprived of its protective skin layer and soon becomes the victim of apple rots.

AFTER-STORAGE BEHAVIOR OF APPLES

If the storage rooms are opened but little and the temperature is held constantly at 32° F., apple scald may not become evident until the apples are removed from storage. Its rate of development after removal will depend upon the temperature to which the fruit is exposed. During the winter months the apples are often passed on to the consumer before the scald becomes seriously evident, but during the spring months, especially the later ones, the disease is likely to develop in transit or on the market.

In many of the experiments previously reported a record was kept of the condition of the fruit at the time of its removal from storage, as well as its condition after it had become warm. The results are shown in table 4. It will be seen that apples that showed no scald while still in storage often became badly scalded a few days after removal and that those showing scald in storage had the disease greatly intensified by exposure to the warm air.

TABLE 4.—*Typical results showing the development of scald after the removal of apples from storage*

[The apples had not received ventilation or oiled-wrapper treatment. The eastern apples were held for 3 days at 70° F. and the northwestern apples for 7 to 10 days at 55° to 60° before the second inspection]

Variety	Degree of scald		Variety	Degree of scald	
	Upon removal from storage	After fruit had become warm		Upon removal from storage	After fruit had become warm
Eastern apples:	*Percent*	*Percent*	Northwestern apples—Con.	*Percent*	*Percent*
Grimes Golden	0	48	Yellow Bellflower	0	15
Do	3	42	York Imperial	12	47
York Imperial	0	38	Do	5	51
Do	4	46	Stayman Winesap	0	19
Stayman Winesap	2	22	Do	4	16
Arkansas	0	48	Do	3	15
Do	11	75	Arkansas	19	23
Northwestern apples:			Do	12	17
Grimes Golden	0	35	Rome Beauty	0	11
Do	0	25	Do	2	22
Do	5	31	Winesap	2	9
Do	3	36	Do	10	30

LOSSES FROM SCALD

Market-inspection reports show apple scald is a close second to blue mold in the losses on apples not protected with oiled paper. From the middle of December till the close of the apple season one may find apples offered at 10 to 40 percent discount on account of

scald. The depreciated price may be entirely due to the bad condition of the fruit at the time of sale, but it is often to be partly attributed to fear that the disease will become rapidly worse. When scald begins to appear in commercial storage lots the dealer knows that the fruit cannot safely be held for more favorable prices, and it is usually moved to market and sold for what it will bring. The losses and spoilage from scald vary with the season, the city, and the abundance of the crop. More scald is evident on southern markets than on northern ones, more during warm periods than during cool ones, and more in a year when the fruit moves slowly than when there is a ready sale.

Besides the wastage of fruit and the depreciation in price resulting from scald, there are general effects upon distribution and consumption that are distinct handicaps to the apple industry. The disease is a limiting factor in distribution to smaller centers and in after-storage shipments in general. The apples that are rushed through the market as scald begins to develop often become badly scalded on the hands of the consumer, not only causing him a direct loss but also preventing him from continuing as a free buyer of apples.

SUMMARY

Susceptibility to scald varies with the season and with orchard conditions and management. Early picked and poorly colored fruit is extremely susceptible to scald, whereas well-colored, well-matured apples are more resistant to the disease.

Low temperature and prompt cooling are of first importance in delaying the development of scald.

Aeration is a preventive of scald, the success of the treatment varying with the thoroughness with which it can be carried out. Aeration during delayed storage is particularly important and valuable.

Storing the fruit in hampers, ventilated barrels, or baskets decreases the development of scald. Conversely, storing it in tight barrels and tight sacks favors the development of the disease.

Oiled-paper wrappers are the most complete preventive of scald that has been found.

When properly handled, shredded oiled paper has given practically as good scald control as the oiled wrappers, but the paper must be well distributed in the package.

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